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## FOREWORD

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Kernenenergie (Nuclear Energy), Vol 3 No 8,  
Berlin, August 1960]

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## ACTIVITY CALCULATIONS FOR THE FIRST CYCLE OF A PRESSURIZED WATER REACTOR INSTALLATION

(Communication from the Scientific-Technical  
Bureau for Reactor Construction, Berlin-Pankow)

[Following is the translation of the introductory  
abstract to an article by A. Rau and G. Schumann in  
Kernenenergie (Nuclear Energy), Vol 3, No 8, Berlin,  
August 1960, page 707]

The concentration of the corrosion products in the heat transfer system, the thickness of the corrosion products deposit layer, and the activity of the corrosion products in the heat transfer system and in the deposit layer have been treated theoretically for the first cycle of a pressurized water reactor. The results for a steady state as well as for abnormal (accident) cases permit determination of the above values. Important conclusions for practical applications can be delineated from these results. The results show, for example, that regarding the radiation damage at the decay rates of up to several tens of days, the maximum cobalt content in the high grade steel should not necessarily be under 0.05 per cent, as long as it does not pertain to the casing material of the fuel elements, and that the employed welding material and cobalt-stellite surfaces are under the permissible values. These statements are based on a requirement that the activity, determined by the cobalt content in the high grade steel, and the activity due to the welding material or cobalt-stellite does not exceed the activity of other corrosion products. A detailed discussion of these questions is given in Section 4 [of this article].

The cobalt-stellite abrasion during the operation of the shut-off valve and the intrusion of active substances are handled as accident cases. It is shown that, regarding the radiation danger, the cobalt-stellite abrasion is of no importance. An intrusion of 1000 gram-equivalents of radium into the heat transfer system yields to a maximum increase of the total activity by a factor of 0.07 or to a 160-fold increase in the activity of the corrosion products in a steady state condition of the operation. By such an intrusion the additionally caused activity of the deposited layer is at the maximum about 20-fold larger than the activity in a steady state condition. As the accidents

with the fuel elements cannot be remedied during the operation, the activity in the heat transfer system as well as in the deposit layer is increased; therefore, in consideration of the casing material corrosion of the fuel elements, the above given values for the maximal permissible cobalt content in the high grade steel are on the safe side.

The treatment of other materials and other parts of the installation, which also contribute to the activity of the first cycle (e.g., casing of the fuel elements) is similar to the examples given here.

ELECTRON ABSORPTION ION SOURCE IN WHICH VAPOR  
BEING TESTED IS KEPT AWAY FROM THE DISCHARGE CATHODE

[Following is the translation of the introductory abstract to an article by M. von Ardenne and K. Steinfelder in Kernenenergie (Nuclear Energy), Vol 3, No 8, Berlin, August 1960, page 717]

Construction and operation of an electron absorption ion source is described, in which practically no vapor of the tested material comes in contact with the heated cathode, i.e., with its ambient surroundings. This is achieved by using in construction a vapor condensation tube, cooled to a low temperature and through which passes the electron beam. The tube is placed between the ion absorption chamber and the cathode chamber. The great advancement resulting from such a keeping away the tested vapor from the cathode chamber, is shown by the mass spectra of anthracene. Only the new source with the separated cathode chamber gives mass spectra in which the lines of the non-destroyed anthracene molecules are darkened the most and in which the otherwise observed lines of metal oxides of the cathode material and the lines of complet ions (test vapor metal oxides) are missing.

MISCELLANEOUS INFORMATION ON NUCLEAR  
PHYSICS IN BLOC COUNTRIES

[Following is the translation of notes in  
Kernenenergie (Nuclear Energy), Vol 3, No 8,  
Berlin, August 1960, pages 808-810]

GDR. The extensive utilization of radioactive isotopes in the peoples economy, the construction of nuclear power plants and other nuclear power installations, and the construction of nuclear-physical and radiochemical research laboratories has faced the specialists of the construction industry and construction institutes with partially completely new types of problems which in essence have arisen because of the safety considerations regarding the radioactive radiation.

Therefore courses have been organized at the School of Technology for Construction, Leipzig, where construction specialists (certified engineers and engineers) in lectures and in practical exercises become acquainted with the foundations of applied radioactivity with a special consideration for radiation absorption, the computation of simpler radiation safety installations, and with the most important protective materials. In lectures, the experiences are reported which have been gained in the construction of the Central Institute for Nuclear Physics, Rossendorf, and in the construction of the Nuclear Power Station I, Neuglobsow, among others.

The length of the course is 11 days. The admission fee for participants is DM 160.00. Interested persons should inquire at the School of Technology for Construction, Dean of Physics, Leipzig S 3, Richard Lehmann Strasse 32.

GDR. The duoplasmatron ion source, developed at the Manfred von Ardenne Research Institute, Dresden - Weisser Hirsch, is being produced now with various emission openings. With an emission opening of 1.4 millimeters diameter and with hydrogen gas as the source, it delivers in a continuous beam operation an ion beam of one ampere. The protons constitute about 60 per cent of the ion beam at five amperes discharge current, and it can be raised above 85 per cent, in an impulse beam operation with 20 to 100 amperes discharge currents. The efficiency of the source in a continuous beam operation is almost 100 per cent, as computed on

the basis of the gas consumption and the ion portion in the beam. The distribution of the starting energy of ions is between 6 and 20 electron volts according to the discharge energy (the potential value of the so-called "intermediate electrode").

As an electron generator, the duoplasmatron source also has very favorable specifications, for example, for use with electron accelerators. In this application it delivers an electron beam of up to seven amperes. The particle density reaches values of 65 amperes per square centimeter for protons and 500 amperes per square centimeter for electrons in a continuous beam operation.

For nuclear fusion research, the molecular ion portion (the deuteron portion) can be increased to a value of 60 per cent of the utilized deuterium ion beam with a special discharge arrangement.

GDR. The portable, battery operated nuclear radiation measuring apparatus, Curiemeter VA-J-10, produced by the VEB Vakutronik, Dresden, is suited for gamma dosage measurement (scale ranges, based on cobalt-60: 0.4, 4, and 40 milliroentgens per hour), for beta radiation measurement (scale ranges, based on phosphorus-32:  $10^4$ ,  $10^5$ , and  $10^6$  beta particles per minute per square centimeter entering the ionization chamber), and for pulse density measurements (scale ranges:  $10^3$ ,  $10^4$ , and  $10^5$  pulses per minute). The whole instrument consists of a scale unit, a probe sensitive to gamma and beta radiation above 0.2 million electron volts with a Vakutronik counting tube VA-Z-111, earphones for an acoustic reproduction of the radiation, and two carrying straps and other accessories. The probe has in its head an adjustable screen arrangement to distinguish (i.e., to determine) the radiation types. According to the purpose of measurement, it can be used as needed with a short handle as a hand probe or with an extension as a long-handled probe.

No tables are necessary to evaluate the results obtained with the Curiemeter VA-J-10. If a mixed beta and gamma radiation is present, it is possible to measure them separately without conversion by using the "gamma compensation." A constant background (zero-effect or contamination of apparatus parts) can also be suppressed with the gamma compensation. If the type of radiation measured differs from the one specified for calibration, but the radiation type of the measured substance or its energy spectrum is known, then the resulting energy-dependent errors can be decreased with correction factors. By using the measurement factors which are given in the apparatus description, it is possible to determine (i.e., to measure) the beta activity in liquids. In very strong radiation fields, i.e., when the gamma radiation dosage or the beta activity is considerably



higher than the apparatus range, the falling back of the scale indicator [characteristic for Geiger-Muller type instruments] is prevented by a special switch (warning switch). In this case there is a warning tone of 1.5 to 2 kilohertz frequency in the earphones.

The universality of the Curie meter VA-J-10 can be improved further with an additional probe having a window counting tube. This probe should have the newly developed window counting tube VA-Z-312. It makes it possible to determine additionally also the alpha and soft beta rays.

GDR. The surface density measuring apparatus VA-T-70, made by the VEB Vakutronik, Dresden, is being used for the determination of surface density (the surface density-- [Flachendichte]--till now was often called the "surface weight"--[Flachengewicht]--grams per square meter) of ligamentous materials, e.g., of rubber, synthetic, or metal foils, or of paper bands without direct contact. It is possible with certain limitations to determine the thickness of a material directly (e.g., at a constant specific weight of the measured material), and to calibrate the apparatus in thickness units. If the apparatus is used with a tolerance determination instrument or with an attached recorder, the deviations from the required thickness or from the required surface density can be directly read or registered. In contrast to the so-called radiation compensation, where additional preparation is necessary, the surface density measuring instrument VA-T-70 uses an electrical potential compensation. Here only one radioactive preparation is used for the whole apparatus, and, in the interest of low activity levels, the total activity can be held very low. A further advantage resulting from this method is the convenient and simple operation of the instrument. All necessary adjustments during the operation can be done from a central station which can be set up independently from the place of measurement (maximum distance 100 meters).

GDR. The gamma relay VA-T-64 made by the VEB Vakutronik, Dresden, is a threshold measuring device to be used for industrial purposes for the construction of radiation barriers. These barriers operate similarly to the photocell barriers, but instead of light they use the penetrating gamma radiation of radioactive isotopes and the halogen counting tube as the detector. The VA-T-64 consists of a sensing element, VA-T-64.1, with one or more halogen counting tubes, an amplifier, an electronic relay, and a power supply unit. The distributor, VA-T-64.2 of the apparatus contains a rectifier for feeding the electromagnetically regulated isotope radiation head, VA-H-410, and gives a low potential alternating current for the operation of signal lamps. All feeding and relay connections are conducted

over the distributor and secured with fuses. Both instrument units are placed in watertight cast iron boxes and are thus suited for industrial use under exposed conditions.

When gamma radiation of a certain intensity hits the sensing unit, an electromechanical relay is excited across the electrical connection. With the use of the relay, a communication, signal, or control installation can be operated. By decreasing a certain radiation intensity, the relay is disconnected. The VA-T-64 operates reliable if the ratio of both radiation intensities is large than or equal to 4:1. The decrease of the gamma radiation, as necessary for the signal is achieved by placing the liquid or solid material to be measured between the radiation source and the radiation receiver.

On the basis of these working characteristics, the gamma relay is suited for liquid level control of almost any material in containers. As the VA-T-64 can be attached to the outside of a container, it is especially well suited to control corrosive, explosive or viscous liquids, or liquids kept under high pressure. The VA-T-64 can also be used to control material transport on conveyor belts, or the conveyors in mining industry, etc. In the chemical industry, reactions can be controlled in containers where separate layers are formed between media of different specific weights.

GDR. In VEB Central Development and Construction for Automotive Production, Karl Marx-Stadt, a laboratory for isotope technology was built as a socialistic community project. With this construction, the automotive industry is in the position to use isotopes for measuring resistance to wear.

GDR. Five months before the deadline date, the newly developed isotope apparatus for a damage-free material testing in the series production has been put in operation at the peoples-owned Transformer and X-ray Plant, Dresden. The instruments use iridium-16 [sic! - probably iridium-196, or any other isotope] as a radiation source.

USSR. In the new nuclear power plant, Beloyarsk, Ural area, assembly of the reactor started in June [1960]. The power plant should have a capacity of 200 million watts. This is a 40-fold increase over the capacity of the first nuclear power plant in the world which has been in operation in Moscow for 6 years.

USSR. More than 1500 installations are set up in the Soviet industry for radioactive product control of metal products. In the USSR about 50 research institutes and construction offices are engaged in the development of automatic testing and control instruments which use isotopes. By using radioactive isotopes the work productivity in a Lenin-grad rolling-mill has increased already by 16.5 per cent, in a cold rolling-mill even an increase by 36 per cent has

been achieved, while in a sheet steel plant it was possible to set the waste quota to one-quarter of the previous one.

USSR. Visotskiy, chief of the Laboratories for Radioactive Isotope Research of the Scientific Research Institute for Automotive and Motor Technique announced that in the USSR radioactive isotopes are used with success to measure resistance to wear in the control of the life span of automobile motor parts. Usually a micrometer is used to measure the wear and the machines are dismantled periodically for testing. By using isotopes such control can now be accomplished without such cumbersome processes. A pin containing radioactive material--the so-called wear "proofer"-- is inserted into a small hole in the part to be tested. When the wear has advanced so far that the seal of the opening is worn away, the radioactive material is introduced into the circulating oil and the degree of wear can be determined by its activity. The detailed study of wear makes it possible to find means to increase the life span of machinery.

USSR. Professor Bruno Pontecorvo, Dubna, was named to membership of the Academy of Sciences, USSR. Professor V. Emelyanov, till now chief of the Central Bureau for Atomic Energy, was appointed Chairman of the Atomic Energy Commission of the USSR.

Czechoslovakia. Thirty-eight lives were saved by a sensational new operation method by the Prague physicians. The Czechoslovak medics made it possible to replace radiation damaged urinary passages which were affected by x-rays during a treatment of cancerous tumors.

At the Sixth Scientists Conference of the Medical Faculty, Karlova University, the research results of 27 clinics were evaluated; the action of cysteamine, the up to now most effective agent to increase the resistance to radiation of an organism, could be elucidated for the first time. The scientists ascertained that the studies on protein transformations in an organism have advanced significantly. By use of isotopes, new knowledge has been obtained regarding the mutual interactions of the tissue proteins; a diagnostic method, based on the observations of proteins in blood, has been developed.